

# Expanding your graphical repertoire

2023 MIDFIELD Institute

Richard Layton resides online at

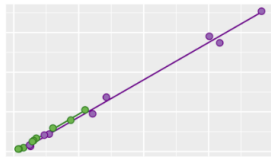
- <https://www.graphdoctor.com>
- <https://github.com/graphdr>

## Variables, design, message

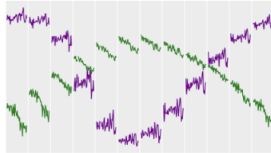
*Trees, Maps, and Theorems* by Jean-luc Doumont (2009) inspired the four main topics.



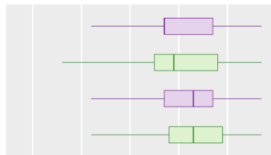
**Comparing data**



**Revealing correlations**



**Showing evolution**



**Displaying distributions**

## § Comparing data

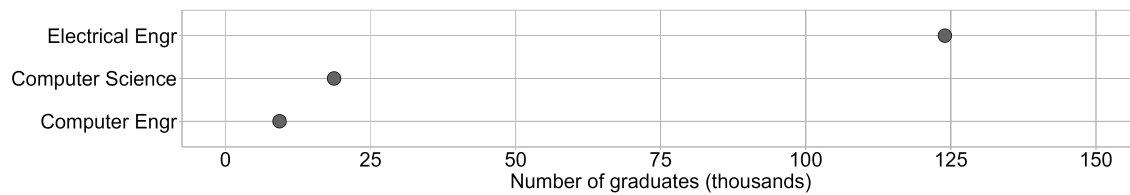
### [4] Data

Representation at graduation in 3 engineering programs, 19 US institutions, 1987–2018

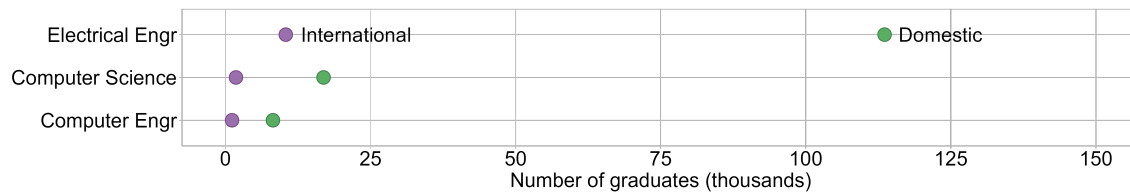
Square brackets [i] give the slide number.

	origin	sex	Electrical Engr	Computer Engr	Computer Science
	<char>	<char>	<int>	<int>	<int>
1:	International	Female	1865	140	365
2:	International	Male	8530	993	1442
3:	Domestic	Female	23426	702	2923
4:	Domestic	Male	90150	7481	13987

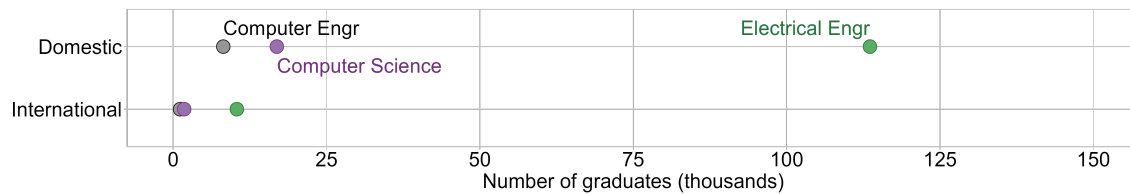
### [5] Dot chart



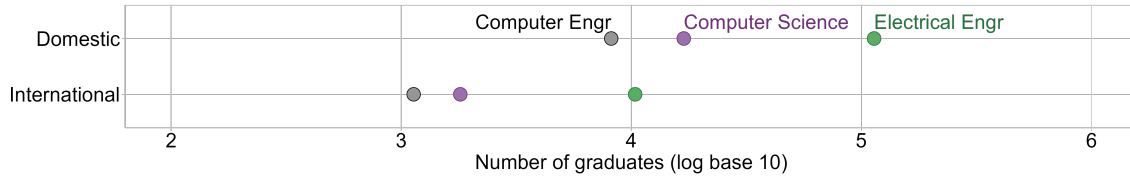
### [6] Add a second category



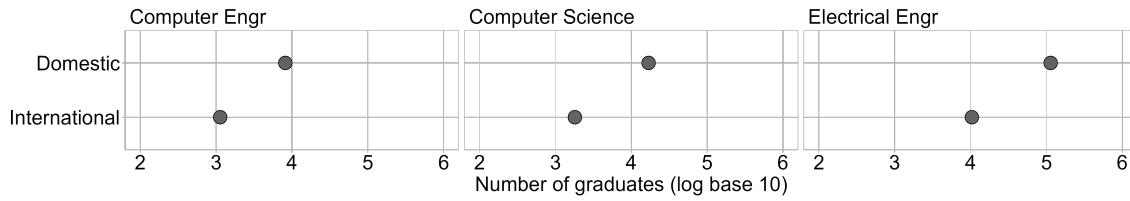
### [7] Exchange mapping of categorical variables



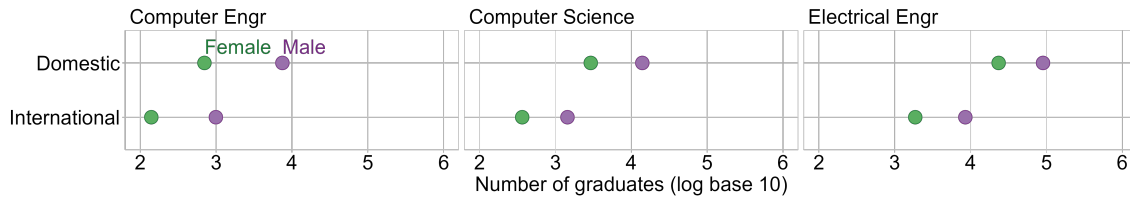
[8] Logarithmic scale for orders of magnitude differences



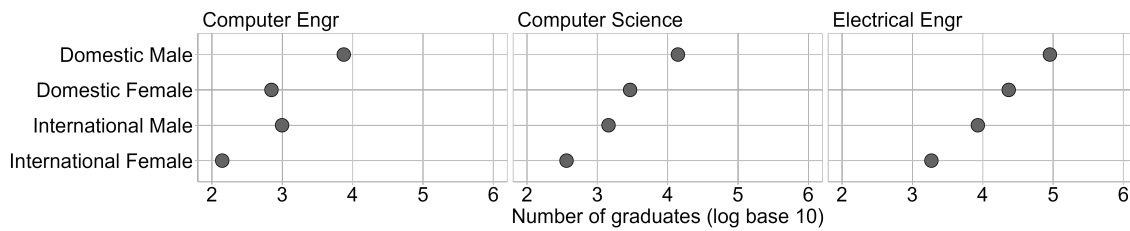
[9] One program per facet



[10] Add a third category

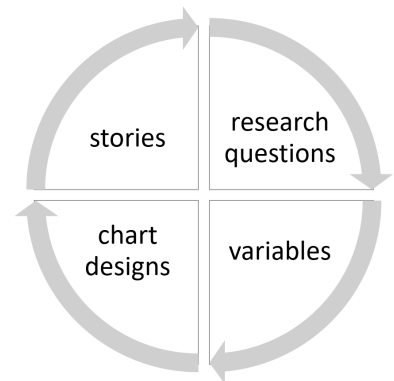


[11] Combine categories



[12] Discussion: Comparing data

What points seem most important to you so far?



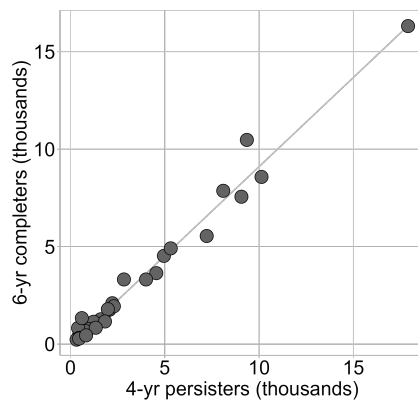
## § Revealing correlations

### [14] Data

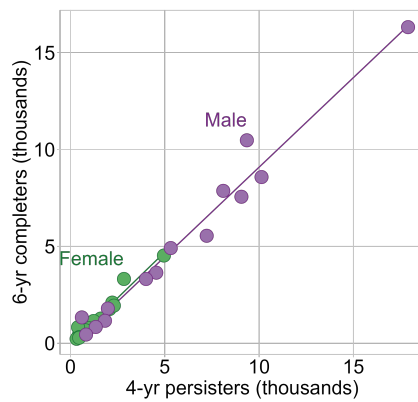
Engineering students at 14 institutions persisting to year 4 and graduating by year 6, 1987-2019

	institution	sex	y4	y6
	<char>	<char>	<int>	<int>
1:	A	Female	4953	4525
2:	A	Male	17897	16312
3:	B	Female	2834	3316
---				
26:	N	Male	1338	838
27:	P	Female	457	283
28:	P	Male	827	447

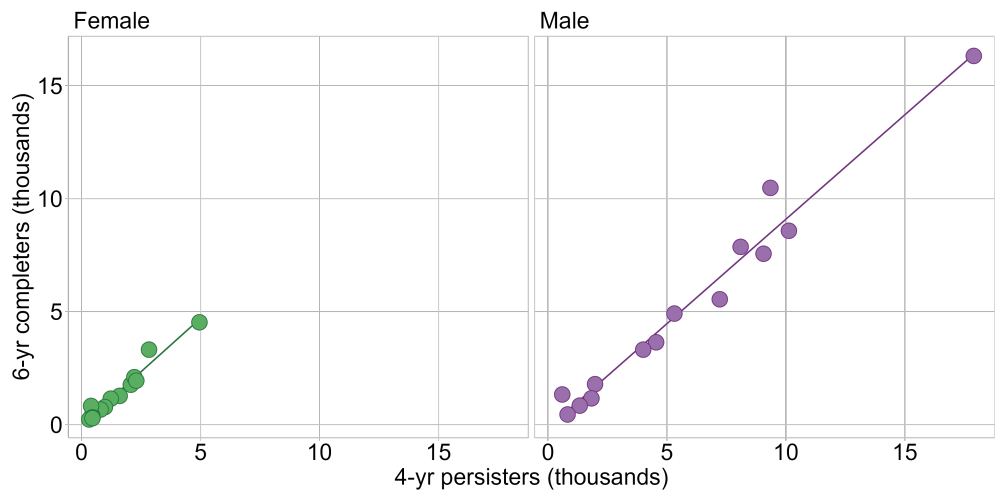
### [15] Scatterplots are designed to reveal correlation



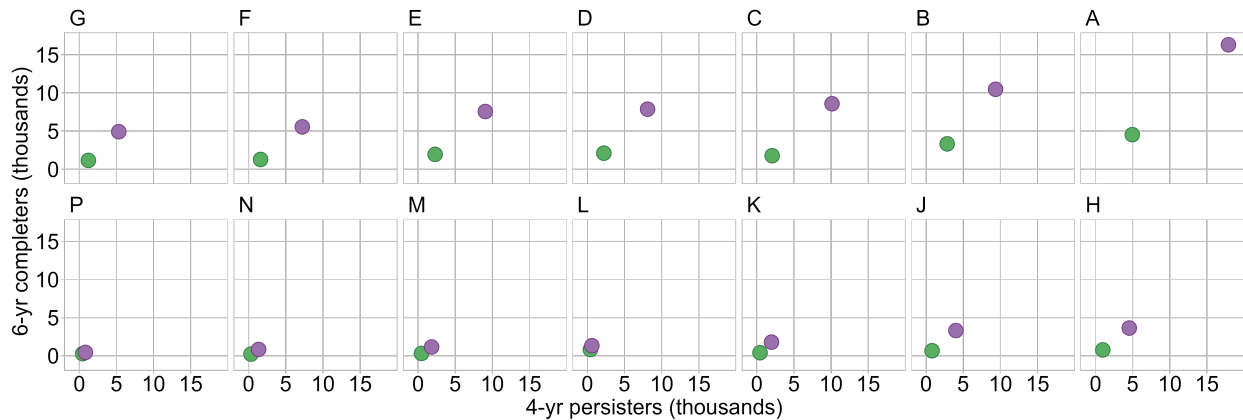
### [16] Add a category



[17] One facet per sex

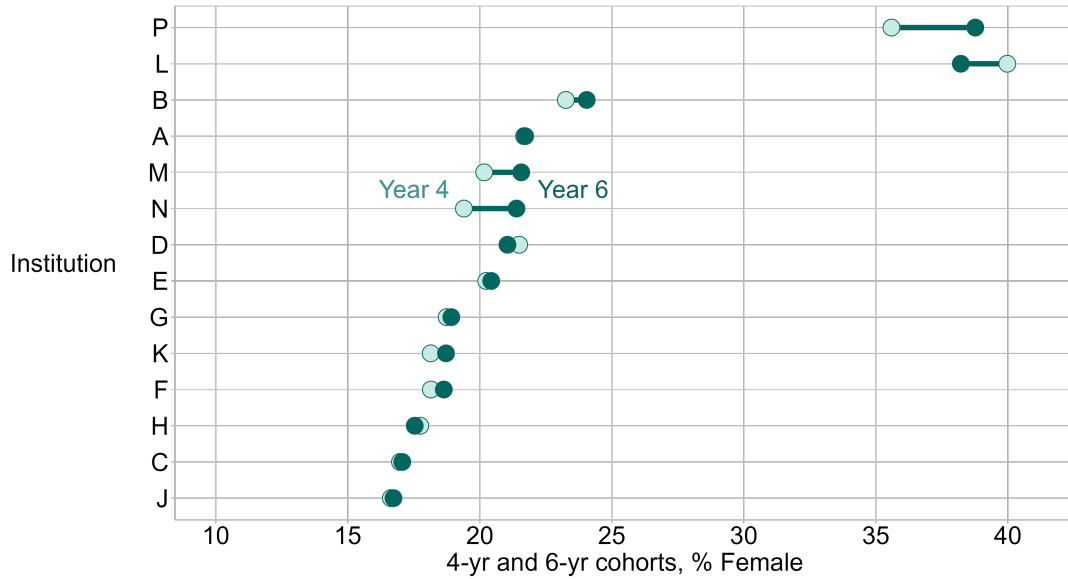


[18] One facet per institution



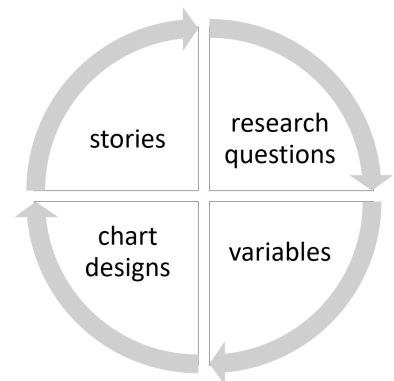
[19] *Change the quantitative variable*

Engineering students at 14 institutions persisting to year 4 and graduating by year 6, 1987–2019



[20] *Discussion: Revealing correlations*

- We saw a correlation.
- We changed the emphasis.
- Which chart tells a more compelling story?



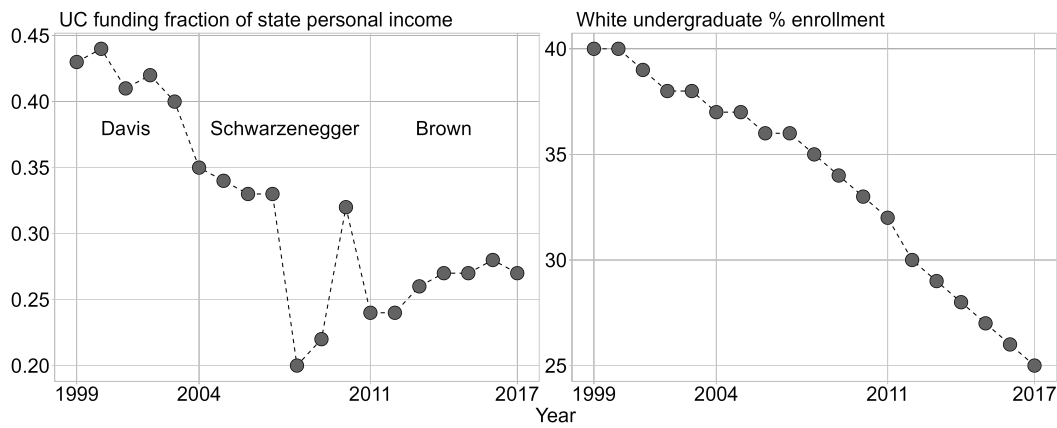
§ Showing evolution

[22] Data

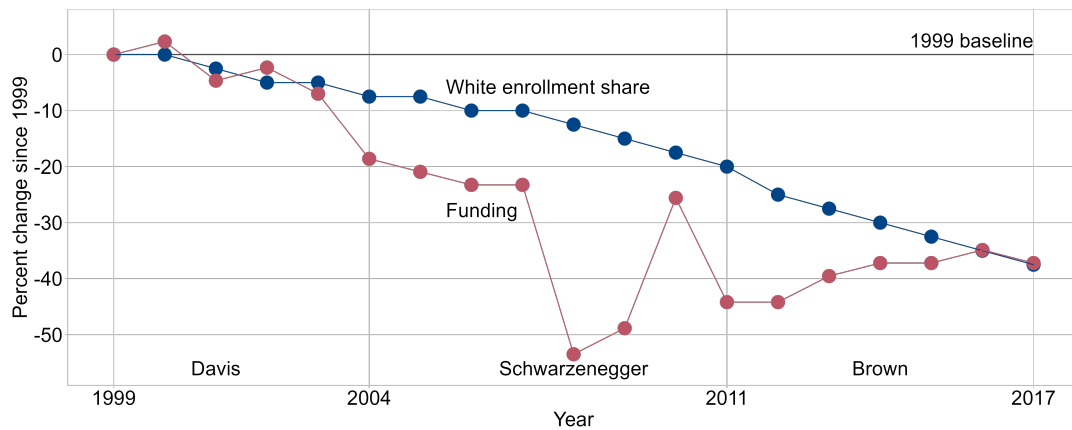
University of California: funding and percent White enrollment, 1999–2017

	Year	Governor	Pct_UG_White	Funding_metric
	<num>	<char>	<num>	<num>
1:	1999	Davis	40	0.43
2:	2000	Davis	40	0.44
3:	2001	Davis	39	0.41
---				
17:	2015	Brown	27	0.27
18:	2016	Brown	26	0.28
19:	2017	Brown	25	0.27

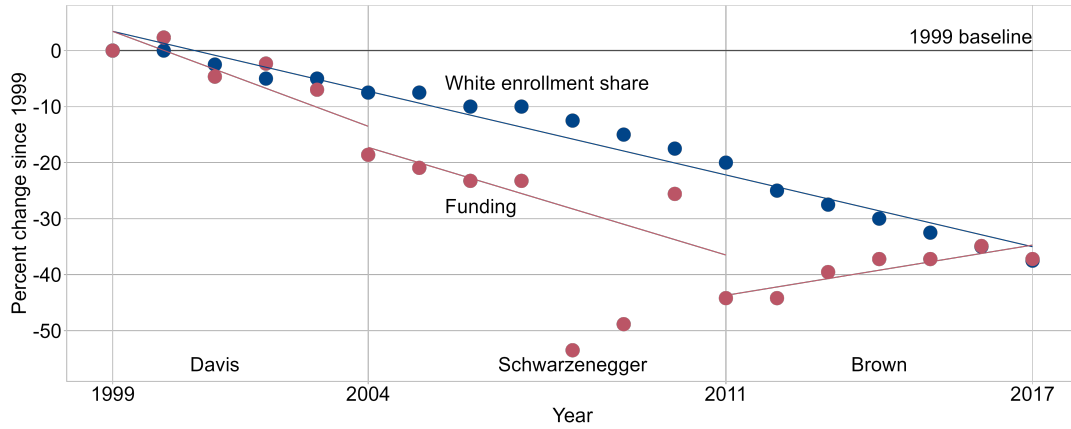
[23] Two time series



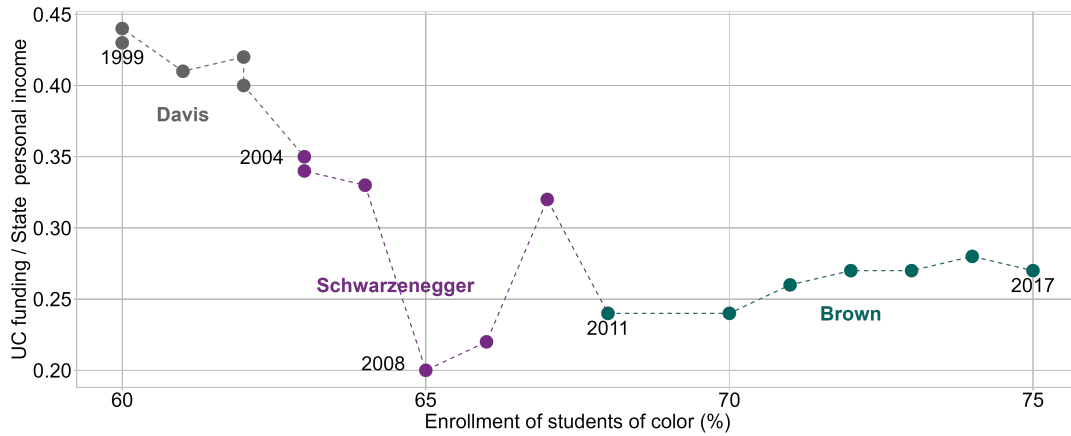
[24] Indexed time series



[25] Parallel lines indicate possible correlation



[26] Connected scatterplot

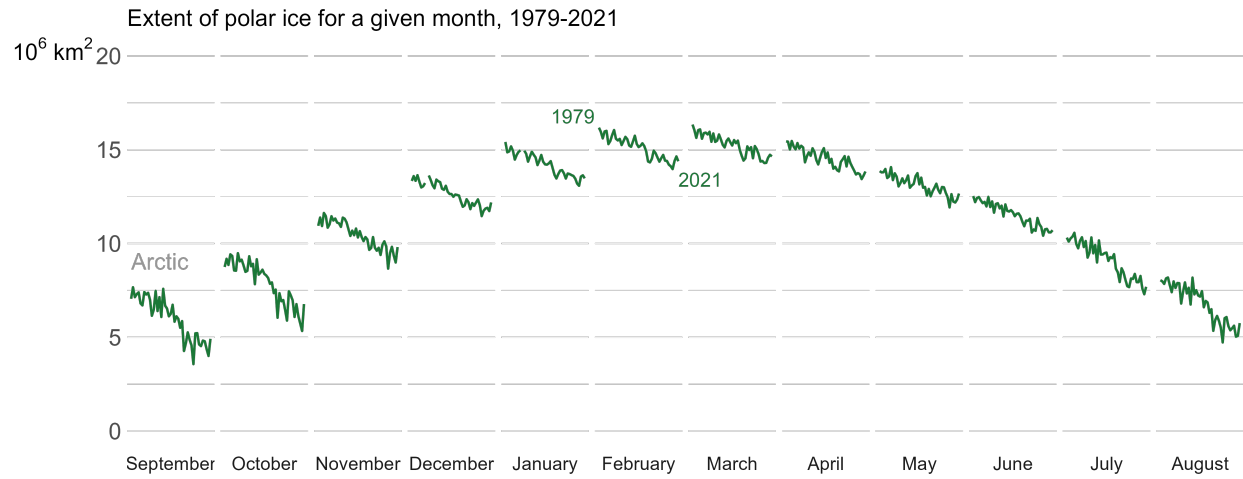
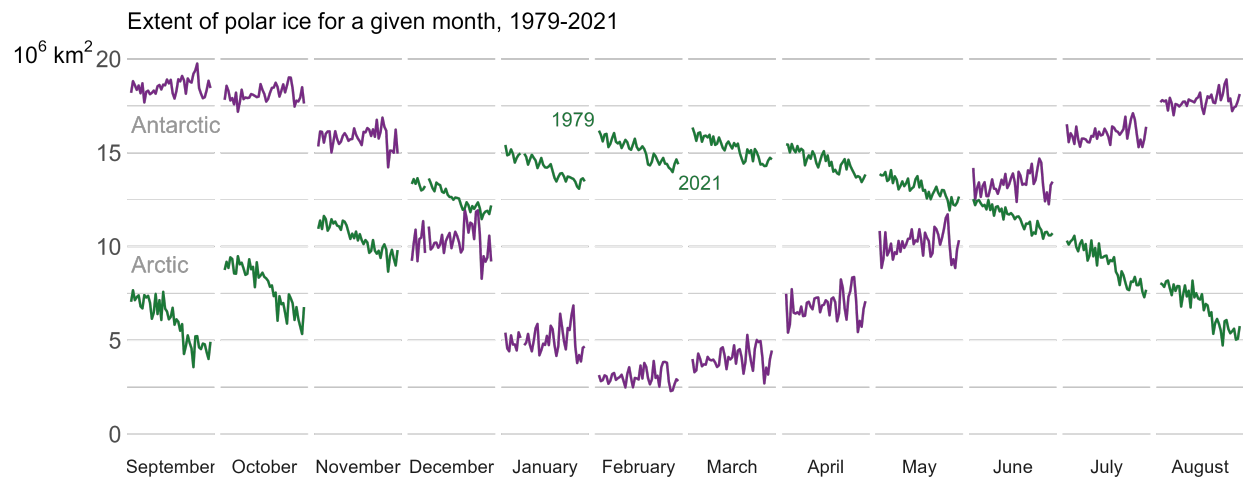


[27] Data

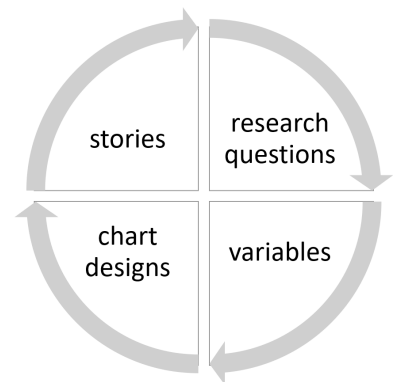
Extent of polar ice (millions sq km) 1979–2021

	hemis	month	year	extent
	<char>	<fctr>	<int>	<num>
1:	Arctic	September	1979	7.051
2:	Arctic	September	1980	7.667
3:	Arctic	September	1981	7.138
---				
1030:	Antarctic	August	2019	17.478
1031:	Antarctic	August	2020	17.758
1032:	Antarctic	August	2021	18.131



*[28] Cyclic time series**[29] Add a category**[30] Discussion: Showing evolution*

- Which time series chart design might be used in your own work?
- Explain.



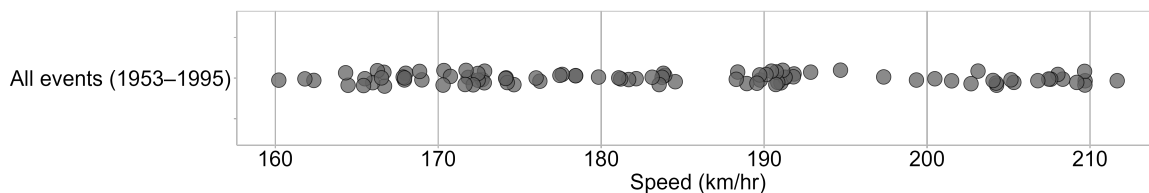
§ Displaying distributions

[32] Data

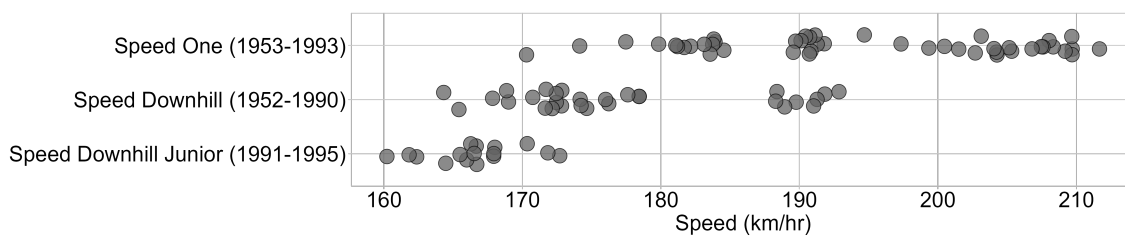
World speed skiing (km/hr) competitions 1953–1995

	Event	Year	Sex	Speed
	<fctr>	<int>	<fctr>	<num>
1:	Speed Downhill	1952	Male	167.85
2:	Speed Downhill	1953	Male	168.86
3:	Speed Downhill	1961	Male	165.42
4:	Speed Downhill	1962	Male	172.85
---				
88:	Speed One	1990	Female	199.35
89:	Speed One	1991	Male	207.59
90:	Speed One	1993	Male	208.33
91:	Speed One	1993	Male	170.30

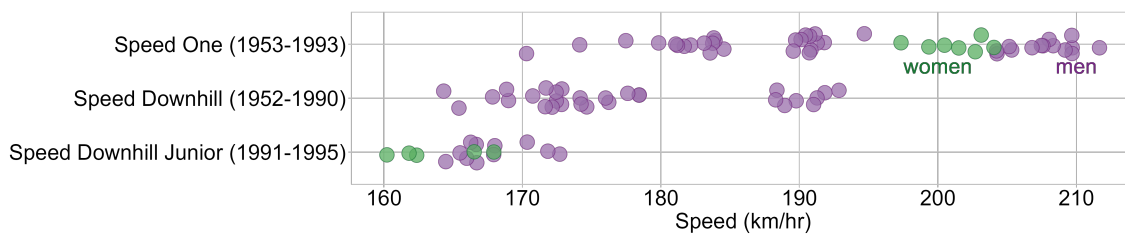
[33] Strip chart



[34] Add a category



[35] Add a second category

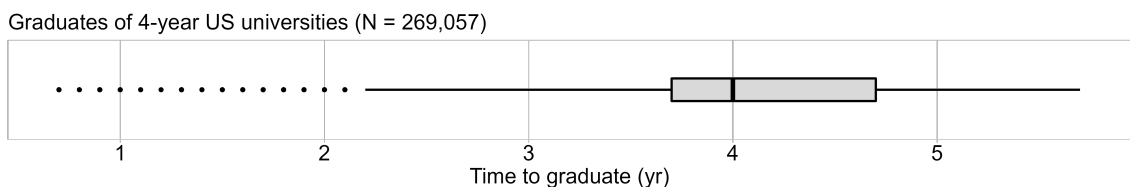


[36] Data

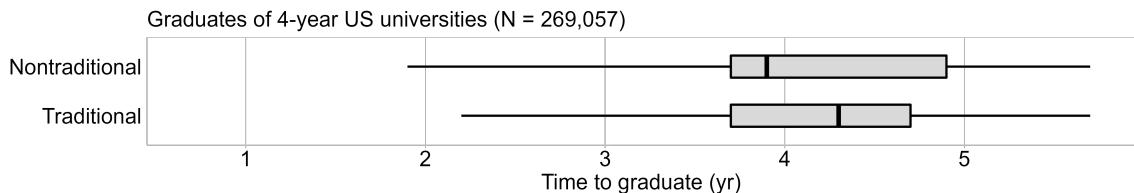
MIDFIELD graduates (N = 270k), enrolled in Engineering, excluding 10th and 90th quantiles

	path	sex	years_to_grad
	<char>	<char>	<num>
1:	Nontraditional	Female	3.9
2:	Nontraditional	Female	1.9
3:	Nontraditional	Female	3.9
4:	Nontraditional	Female	5.3
---			
269054:	Traditional	Male	1.3
269055:	Traditional	Male	3.0
269056:	Traditional	Male	5.3
269057:	Traditional	Male	0.7

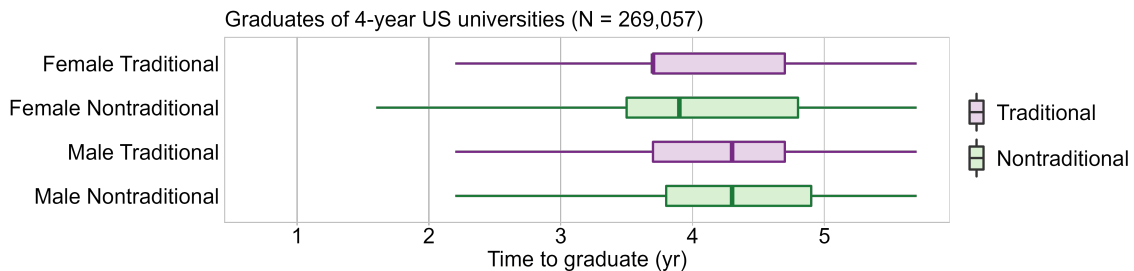
[37] Box and whisker chart



[38] Add a category



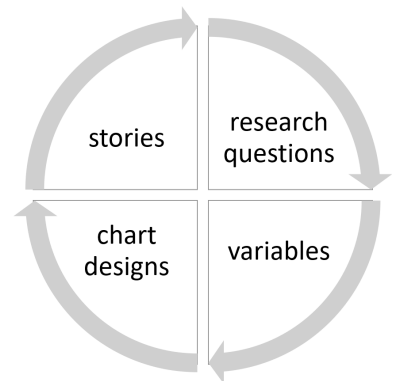
[39] Combine a second category



*[40] Discussion: Displaying distributions*

What MIDFIELD distributions would you like to see:

- what quantitative variable?
- what categorical variables?

*§ Closing discussion**[42] Variables, design, message*

- For you, what was the muddiest point in the session?
  
  
  
  
  
  
  
  
  
  
- Is there a graph design you would have liked to have seen today?
  
  
  
  
  
  
  
  
  
  
- Is there a class of variables you would have liked to have seen today?

## References

- Doumont, Jean-luc. 2009. *Trees, Maps, and Theorems*. Belgium: Principia.
- Fetterer, F., K. Knowles, W. N. Meier, M. Savoie, and A. K. Windnagel. 2017. "Sea ice index, version 3, Sea ice extent and area organized by year." <https://doi.org/https://doi.org/10.7265/N5K072F8>.
- Newfield, Christopher. 2021. "Budget justice: Addressing the structural racism of higher education funding." *Academe* 107 (2): 57–64. <https://www.aaup.org/article/budget-justice#.Ypes1ajMJag>.
- Unwin, Antony. 2015. *GDAdata: Datasets for the Book Graphical Data Analysis with r*. <https://CRAN.R-project.org/package=GDAdata>.